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ABSTRACT

Depending upon the climate, the features of a house will be different to satisfy particular needs: hot, cold, windy, and/or rainy weather. In this activity, students investigate different types of roofs found on various houses in different environments throughout the world. Books and photos are used to provide information. Models of the houses are constructed and tested against various climatic elements. This activity requires an 80-minute time period for completion. (Author/SOE)

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ED 480 784

Activity: **Construct And Test Roofs for Different Climates**

GRADE LEVELS: 3-5

SUMMARY:

We design and create objects to make our lives easier and more comfortable. The houses in which we live are an excellent example. Depending on your local climate the features of your house will be different to satisfy your particular needs; hot, cold, windy, and/or rainy weather. Students should be aware of the different types of roofs found on various houses in different environments throughout the world. This can be done with books and photos. Models of the houses will be constructed and tested against various climate elements.

LEVEL OF DIFFICULTY [1 = Least Difficult: 5 = Most Difficult]

4-difficult

TIME REQUIRED

Two 40-minute classes

COST

varies depending on materials used

STANDARDS:

1.1 Identify materials used to accomplish a design task based on a specific property, i.e. weight, strength, hardness, and flexibility.

1.2 Identify and explain the appropriate materials and tools (hammer, screwdriver, pliers, tape measure, screws, nails and other mechanical fasteners) to construct a given prototype safely.

2.1 Identify a problem that reflects the need for shelter, storage, or convenience.

2.3 Identify relevant design features (e.g., size, shape, weight) for building a prototype of a solution to a given problem.

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WHAT WILL THE STUDENTS LEARN?

Houses in different environments are built differently.

Design techniques.

BACKGROUND INFORMATION:

ADOBE: a brick or building material made of a sun-dried mixture of earth and straw

IGLOO: an Eskimo house usually made of wood, sod, or stone when permanent or of blocks of snow or ice in the form of a dome when built for temporary use

HUT: a small and often temporary dwelling or shelter

People in different parts of the world have different materials that they can use to build their homes and other structures. When building a home, they have to think of how to use these materials to build a house that will work well for where and how they live.

In the southwestern part of the United States, where there is a lot of clay and little wood, people build houses from adobe, a mixture of clay, straw, and water. Adobe houses have very thick walls which keep the houses cool in the hot dry desert weather. Adobe houses would not be good in places where it rains a lot because too much water makes adobe crumble.

The weather in certain tropical islands in the Pacific ocean is hot, but wet. People who live there make their homes from materials that are easy to find such as palm leaves, woven grasses, and bamboo. Sometimes they build the houses on stilts to keep them off the wet ground and to let the breezes move under the house, helping to keep it cool.

Most Eskimos in Alaska and Canada built their houses out of sod or snow. These dome-shaped houses are called igloos. The dome shape of the igloo made it very strong and able to withstand powerful winter storms, also the thickness of the igloo made it a good insulator.

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Some American Indians used to build dome-shaped houses made of poles, leaves, and tree bark. These houses were called wigwams. Indian tribes that moved a lot often built cone-shaped tepees out of buffalo skins or bark. Tepees could be easily built and taken apart quickly. Some Indians lived in more permanent structures called lodges made from logs and sod.

When early American settlers came to New England, they found the ground covered with large stones. They used these stones to build stone houses and fences that you still see in New England today. The northwest part of the United States and Canada have plenty of forests, so most of the houses in these areas are made of wood.

In China, where there are few forests, there are hardly any wooden houses. The chinese people use tile, concrete, and stone to build beautiful pagodas and other buildings.

In parts of Africa, where tall grasses grow, people weave the stems of dried grass together to make thatch huts.

In Tibet, some people even make their houses out of wool! They shear the wool from ox-like animals called yaks. The wool walls keep the houses warm through the cold winter months.

Most houses in the United States today are built of wood, brick, stone, concrete, aluminum, or even glass.

RECOMMENDED RESOURCES:

www.book-of-roofs.net – good pictures and information

eetd.lbl.gov/HeatIsland/CoolRoofs/ - good for background information

www.blwtl.uwo.ca/climate/climate5.htm - good for background information

www.kansai.gr.jp/culture/build/beauty/haya_e.htm - good for background information

www.remembernow.com/eikos/leakyCondos.html - good for background information

MATERIALS:

Cardboard

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Roof materials (can also use whatever is available)--Clay for adobe houses, hay or long grass for grass huts, corkboard, saran wrap for roof for tropics house

straw

sticks and Popsicle sticks

toothpicks

rocks and/or beans

old cloth

Play-doh

string

felt

poster board

golf tees

straws

paper clips

Elements--Water, strainer, ice cubes, hair dryer to produce wind, coins, washers

"Houses and Homes" by Ann Morris

PREPARATION:

Assemble materials for roofs

DIRECTIONS:

1. Read the book Houses and Homes by Ann Morris. It is a good starting point, and can be followed by a brief discussion.

2. Discuss weather conditions of various world regions, how the homes for the region were constructed, and the materials that were used. Children should be able to identify the regions discussed on the globe or world map.

3. Discuss the appropriate materials necessary to survive under the given conditions for a particular region.

4. Divide the students into pairs or small groups. They should choose a region to construct a home for. Using the appropriate available materials they should build

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the house. They may want to look through books for ideas about how to construct their homes.

Some Rules for building the houses and roofs are as follows:

a. Desert – Should be able to keep an ice cube from melting. An ice cube is placed in the center of the house and exposed to wind and heat from the blow dryer for a certain amount of time (one or two minutes). If the ice cube does not melt then the building can withstand the elements of heat and wind.

b. Arctic – Should be able to support snow. Coins or washers are added gradually to the roof at varying weights, to determine if the structure can withstand a large amount of weight from snow. The house should be able to support a specified number (+/-10) of washers or coins to pass the "snow load" test.

c. Tropics – Should be waterproof. The house will be placed on a platform in an empty pan, and then water will be poured through a strainer to simulate rain. Place tissue or other absorbent material in the house first to determine if the house leaks in the "rain". The house must not collapse or leak to pass the test. A standard amount of water should be used (one or two quarts).

5. After all the houses are completed, test each house and allow the children to offer suggestions on how each house could be improved. Remember to consider both materials and structure design for the respective region.

6. After the initial assessment of the houses ask the children to list three positive and three negative aspects of their house. They should collaboratively decide how they would improve the house if they were given the opportunity and how they construct another model for that region.

7. Each group will then give their house to another group, and that group will list the other adjustments that they think should be made in the design or construction of the house.

8. Then they will tell what they think should be fixed and why they would make the changes. The two groups should compare their lists and discuss the differences and similarities.

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9. Each group should then have the opportunity to redesign their home and construct another model. Test the second models, using the same criteria as the first.

INVESTIGATING QUESTIONS:

What do we know about houses and homes?

What do we know about the homes that people in other countries around the world live in?

What types of materials are roofs made of?

What is your roof made of?

Which types of roofs are best for certain climates and why?

What other designs may be beneficial and why?

What would happen if the wrong roof was in the wrong climate?

What materials are the best for the different weather conditions and why?

What are the weather conditions in different regions of the world?

What design withstood the weather best and why?

REFERENCES:

Morris, Ann. Houses and Homes. Mulberry Books. 1995.

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Rubric for Performance Assessment

Activity Title: Construct and test roofs for different climates **Grade Level:**

	1	2	3	4		
Criteria	Beginning	Developing	Proficient	Advanced	Weight (X factor)	Subtotal
DESIGN AND CONSTRUCTION	Design and construction are incomplete.	House shows evidence of hasty construction.	House shows evidence of careful craftsmanship and appropriate use of materials and tools.	House shows evidence of very careful craftsmanship and the design is well thought out for the climate given.		
PERFORMANCE OF HOUSE	Does not withstand given climate.	Able to withstand slight climate conditions.	Able to withstand the climate conditions.	Design creatively protects house from weather conditions.		
DEMONSTRATES UNDERSTANDING	Does not use terms correctly. Is unable to answer questions about climate and/or house design.	Can answer questions about climate and/or house design. Uses terms incorrectly.	Can answer questions about climate and how the conditions dictate various house designs. Uses the terms correctly.	Can answer questions about climate and house designs. Uses terms correctly and offers suggestions for houses in area.	**Total:**	

Teacher Comments:

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Name _____

Construct and test roofs for different climates worksheet:

Choose an environment to build your house and roof for:

1.Arctic 2.Desert 3.Tropics

List some characteristics that your house and roof need to have:

Draw your house and roof and label its parts and the materials you used to build it.

After testing your house, do you need to make any adjustments to the design?

If so, what will you do to fix it?

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PreK-12
ENGINEERING

Activity Evaluation Form

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Activity Name: _____

Grade Level the Activity was implemented at:_____

Was this Activity effective at this grade level (if so, why, and if not, why not)?

What were the Activity's strong points?

What were its weak points?

Was the suggested Time Required sufficient (if not, which aspects of the Activity took shorter or longer than expected)?

Was the supposed Cost accurate (if not, what were some factors that contributed to either lower or higher costs)?

Do you think that the Activity sufficiently represented the listed MA Framework Standards (if not, do you have suggestions that might improve the Activity's relevance)?

Was the suggested Preparation sufficient in raising the students' initial familiarity with the Activity's topic (if not, do you have suggestions of steps that might be added here)?

If there were any attached Rubrics or Worksheets, were they effective (if not, do you have suggestions for their improvement)?

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Title: PreK-12 Engineering Activities

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2) Invent a Backscratcher from Everyday Materials, Grades PreK-2
http://www.prek-12engineering.org/data/d28/Backscratcher.pdf

3) Compare Human-Made Objects with Natural Objects, Grades PreK-5
http://www.prek-12engineering.org/data/d34/HumanvsNatural.pdf

4) Do Different Colors Absorb Heat Better?, Grades PreK-2
http://www.prek-12engineering.org/data/d37/Absorbheat.pdf

5) Which Roof is Tops?, Grades PreK-2
http://www.prek-12engineering.org/data/d44/RoofTops.pdf

6) Make Your Own Recycled Paper, Grades PreK-2
http://www.prek-12engineering.org/data/d56/Recycle.pdf

7) Build an Approximate Scale Model of an Object Using LEGOs, Grades 3-5
http://www.prek-12engineering.org/data/d3/LegoScaleModel.pdf

8) Design Weather Instruments using Lego Sensors, Grades 3-5
http://www.prek-12engineering.org/data/d4/LegoWeather.pdf

9) Space Shelter, Grades 3-5
http://www.prek-12engineering.org/data/d5/SpaceShelter.pdf

10) Build a Bird House, Grades 3-5
http://www.prek-12engineering.org/data/d6/BirdHouse.pdf

11) Ball Bounce Experiment, Grades 3-5
http://www.prek-12engineering.org/data/d6/BallBounce.pdf

12) Make an Alarm!, Grades 3-5
http://www.prek-12engineering.org/data/d11/MakeAlarm.pdf

13) Design Packing to Safely Mail Raw Spaghetti, Grades 3-5
http://www.prek-12engineering.org/data/d17/MailSpaghetti.pdf

14) Disassemble a Click Pen, Grades 3-5
http://www.prek-12engineering.org/data/d33/clickPen.pdf

15) Construct And Test Roofs for Different Climates, Grades 3-5
http://www.prek-12engineering.org/data/d35/ClimateRoof.pdf

16) Compare Fabric Materials, Grades 3-5
http://www.prek-12engineering.org/data/d36/Fabric.pdf

17) A House is a House for Me, Grades 3-5
http://www.prek-12engineering.org/data/d52/House.pdf

18) Water Filtration, Grades 3-5
http://www.prek-12engineering.org/data/d53/Water Filtration.pdf

19) What is the Best Insulator: Air, Styrofoam, Foil, or Cotton?, Grades 3-5
http://www.prek-12engineering.org/data/d54/BestInsulator.pdf

20) Design a Recycling Game!, Grades 3-5
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21) Tower Investigation and the Egg, Grades 6-8
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24) An Introduction To Loads Acting on Structures, Grades 6-8
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26) Building Tetrahedral Kites, Grades 6-8
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27) Do as the Romans: Construct an Aqueduct!, Grades 6-8
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28) Build an Earthquake City!!, Grades 6-8
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29) Design a Parachute, Grades 6-8
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30) The Squeeze is On, Grades 6-8
http://www.prek-12engineering.org/data/d42/Squeeze.pdf

31) Stop The Stretching, Grades 6-8
http://www.prek-12engineering.org/data/d43/StopStretching.pdf

32) Speaker Project, Grades 9-10
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